

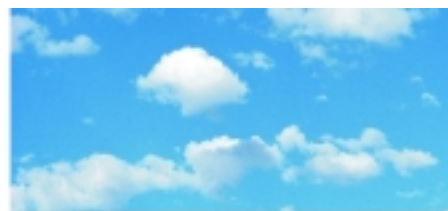
With its dependence on fossil fuels, the U.S. transportation sector is a major contributor to a number of environmental problems. Many steps in the life cycle of fossil fuels, from extraction through their use in automobiles, are detrimental to our environment. Producing and using biofuels for transportation offers environmentally friendly alternatives. The U.S. Department of Energy (DOE) is working with the U.S. fuels industry and automobile manufacturers to commercialize domestically produced, cleaner-burning fuels that can be used in increasingly efficient vehicles.

Greenhouse gas emissions

Producing and using ethanol from biomass feedstocks can dramatically reduce net greenhouse gas emissions. Carbon dioxide is a major greenhouse gas that has been linked to global climate change. The use of ethanol reduces the amount of CO₂ being released into the atmosphere. The carbon in the plants, which is converted to ethanol, comes from the CO₂ in the atmosphere. The end result is that ethanol from biomass produces 96% less CO₂ than gasoline.

Urban air pollution

Ethanol is also an effective tool for reducing air toxics that come from the transportation sector. These are pollutants that the U.S. Environmental Protection Agency classifies as known or probable human carcinogens. Air toxics are weighted according to the relative level of risk for each of the toxic compounds emitted. Based on this potency weighting system, ethanol use results in an overall lower weighted risk factor for air toxics including benzene, formaldehyde, acetaldehyde, and 1,3-butadiene. Biodiesel in a 20 percent blend



with petroleum diesel reduces visible smoke and odor, particulate matter, CO, total hydrocarbons, and sulfur dioxide (SO₂).

Water pollution

Water pollution associated with gasoline includes marine oil spills, groundwater contamination from underground gasoline storage tanks, and runoff of vehicle engine oil and fuel. According to the U.S. Environmental Protection Agency, more than 25 percent of the Nation's one million underground gasoline and oil tanks leak into groundwater. Oil and gas leaks from cars and trucks collect on pavement and are carried to streams, lakes, rivers, and bays.

Ethanol can replace the most toxic parts of gasoline with a fuel that quickly biodegrades in water. Ethanol spills or leaks do not pose environmental hazards. Biodiesel is biodegradable in water and is becoming an attractive alternative to petroleum diesel for use in marinas, tourist boats, and launches.

Waste disposal

Almost half of U.S. landfills are close to capacity and are expected to close in the near future, and the rate at which we produce waste continues to increase. Disposal costs are increasing as available landfill space decreases. This is especially problematic for the agricultural and forest products industries, which produce huge amounts of waste each year. One possible solution is to convert this waste into biofuels.

Tropospheric ozone formation (smog)

Ozone occurs in two places in the atmosphere: in the stratosphere, where it protects us from harmful ultraviolet rays, and in the troposphere, or ground level, where it is (in

large quantities) a toxic gas and a powerful oxidizing agent. When fossil fuels are burned, pollutants such as hydrocarbons, NO_x, and CO—all ozone precursors—are emitted into the Earth's troposphere. Biofuels help combat tropospheric ozone formation because they emit fewer ozone-forming pollutants than petroleum fuels.

Acid rain

Fossil fuels contain sulfur. When these fuels are combusted, the sulfur is emitted into the atmosphere as SO₂, which is oxidized into an aerosol of sulfuric acid that is deposited in tiny droplets on the Earth's surface when it rains. This type of rainfall is commonly known as acid rain.

Acid rain causes an estimated \$2 to \$3 billion in damage to agricultural crops in the United States each year. Natural habitats are destroyed. Toxic metal deposits in soil from acid rain are released into lakes and streams.

Replacing petroleum fuels with biofuels can dramatically reduce SO₂ emissions. Any amount of ethanol or biodiesel in blends will displace the corresponding amount of sulfur in petroleum, thereby decreasing sulfur emissions.

All in all, biofuels offer environmentally sound alternatives to fossil fuels. The mission and vision of DOE's National Biofuels Program encompass the growing need to realize the large-scale use of environmentally sound biofuels by adopting and commercializing the best technologies to establish a major biofuels industry.

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